WHAT IS CLAIMED IS:

1. An ion source comprising:

a plasma production vessel which serves as an anode;

a filament provided on one side of said plasma production vessel;

a reflector provided opposite said filament on the other side of said plasma production vessel and kept at a filament potential or a floating potential; and

a magnet for generating a magnetic field in a direction of connecting said filament and said reflector within said plasma production vessel,

wherein a relation

$L < 3.37B^{-1}\sqrt{(V_A)} \times 10^{-6}$

is satisfied, where the arc voltage applied between said plasma production vessel and said filament is $V_A$[V], the magnetic flux density of the magnetic field within said plasma production vessel is B[T], and the shortest distance from a most frequent electron emission point located almost at the tip center of said filament to a wall face of the plasma production vessel is L[m].

2. The ion source according to claim 1, wherein the ion source is a Bernus type.

3. The ion source according to claim 1, wherein said

magnet is an electromagnet or a permanent magnet.

4. A method for operating an ion source which comprises a plasma production vessel serving as an anode, a filament provided on one side of said plasma production vessel, a reflector provided opposite said filament on the other side of said plasma production vessel and kept at a filament potential or a floating potential, and a magnet for generating a magnetic field in a direction of connecting said filament and said reflector within said plasma production vessel, the method comprising a step of leading out an ion beam with the following relation being satisfied,

$$L < 3.37B^{-1}\sqrt{(V_A)} \times 10^{-6}$$

where an arc voltage applied between said plasma production vessel and said filament is $V_A$[V], a magnetic flux density of the magnetic field within said plasma production vessel is B[T], and a shortest distance from a most frequent electron emission point located almost at the tip center of said filament to a wall face of said plasma production vessel is L[m].

5. The method according to claim 4, wherein the ion source is a Bernus type.

6. The method according to claim 4, wherein said

magnet is an electromagnet or a permanent magnet.